ADDENDUM TO
CITY OF BELLEVUE CRITICAL AREAS UPDATE

Risk Analysis of Council-Modified Alternative for Improving Critical Areas Protection

Prepared for

City of Bellevue

CRITICAL AREAS UPDATE

May 2006

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Risk Analysis of Council-Modified Alternative for Improving Critical Areas Protection

Prepared for

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1.0 Introduction

This document is an addendum to *City of Bellevue's Critical Areas Update: Risk Analysis of No Action, Regulatory, City Programs, and Best Available Science Alternatives for Improving Critical Areas Protection*, published on June 16, 2005 (Herrera 2005b).

The 2005 risk analysis and this addendum were prepared in support of the City of Bellevue's proposal to revise its critical areas protection strategy to ensure that the regulation and management of critical areas within the city are based on scientifically defensible principles, in conformance with requirements of the Washington Growth Management Act. The Growth Management Act requires local jurisdictions to include best available science (BAS) in updating their critical areas regulations and policies. Where the jurisdiction departs from best available science, any risks associated with such departures should be identified.

A *best available science* review was first conducted to identify the best protection methods available for critical areas (Herrera 2005a). Then, a risk analysis of four selected strategies was conducted (Herrera 2005b): a No-Action Alternative, a Regulatory Alternative, a City Programs Alternative, and an alternative constructed from best available science recommendations, called the BAS Based Alternative. This addendum incorporates a risk analysis addressing an additional alternative: the Council-Modified Alternative.

This addendum, like the original risk analysis, analyzes the expected risks associated with strategies proposed by the city to protect the following critical areas: geologic hazards, frequently flooded areas, streams and riparian areas, wetlands, shorelines, and wildlife habitat conservation areas. The analysis describes the expected risks to public health and safety that would be likely to result from the Council-Modified Alternative regulating development within geologic hazards and frequently flooded areas. In addition, the analysis describes the risks to ecological conditions that would be expected to result from the Council-Modified Alternative at 5 years and at 50 years after implementation.

2.0 Methods and Assumptions

The risks associated with the Council-Modified Alternative to update Bellevue's critical areas ordinance were evaluated following the same method and assumptions used in the original risk analysis addressing the first four alternatives (Herrera 2005b). This method adapted a model from *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (NMFS 1996). The model uses a matrix of pathways and indicators to determine existing conditions and to evaluate the effect of future activities. The model was adapted to evaluate the risk to public health and safety associated with geologic hazards and frequently flooded areas, as well as the risk to ecological functions provided by shorelines, streams, wetlands, and wildlife habitat.

The following chapters provide an environmental conditions and risk analysis matrix with accompanying text documenting existing conditions for each critical area, along with the results of the risk analysis for implementation of the Council-Modified Alternative. The risk analysis determines how the Council-Modified Alternative would affect each indicator, using the following categories:

- Tending toward a *properly functioning* condition (PFC)
- Tending toward a *not properly functioning* condition (NPC)
- Tending toward a *properly protected* condition (PPC) (in the case of geologic hazards and frequently flooded areas)
- Tending toward a *not properly protected* condition (NPC) (in the case of geologic hazards and frequently flooded areas)
- Not changing the indicator (neutral, N)
- Unknown (U) if the effect of the alternative is not known.

The environmental conditions and risk analysis matrix corresponding to each critical area summarizes the risk analysis results and supporting rationale.

The analysis results obtained using the NMFS (1996) adapted model are based on evaluating the impact of each alternative on an indicator over an entire drainage basin. A number of the ecological indicators, particularly for riparian areas and shorelines, would rate higher if evaluated at a smaller scale such as a stream or shoreline reach or for individual wetlands.

The standard mandated by the Growth Management Act is to *maintain* the structure, value, and functions of critical areas. After completion of the risk analysis using the environmental conditions and risk analysis matrix for each critical area, these data were summarized in a table characterizing the impact of each alternative based on the Growth Management Act standard,

using three categories: if the action continued over the analysis period, critical area functions and public health and safety either 1) would be *maintained* as properly protected or at risk, 2) would *improve* relative to current conditions, or 3) would result in *degraded* conditions. This analysis was completed for both the near term (5 years) and the long term (50 years).

These summary assessments describing the potential impacts of each alternative on existing conditions are the basis for a final environmental impact statement (EIS) developed for the Bellevue critical areas update, to be issued in spring 2006. The final EIS evaluates the No-Action, Regulatory, City Programs, and Council-Modified alternatives. These summary impact assessments are provided in the Summary and Conclusions section at the end of this report. Details of how the assessments were made for the Regulatory and City Programs alternatives can be found in the original risk analysis (Herrera 2005b) and, for the Council-Modified Alternative, in this addendum to the risk analysis.

In the Regulatory Alternative analyzed in the *Risk Analysis of Regulatory, City Programs, and Best Available Science Alternatives for Improving Critical Areas Protection* (Herrera 2005b), the city carried an option to exclude the footprint of existing primary structures from critical area buffers and structure setbacks (see Section 20.25H.035.B on page 6 of 6 in Appendix A to the draft EIS). This option was accepted by the planning commission and confirmed by the city council and is included in the current draft of the ordinance (see 20.25H.035.B). The effect of this footprint exclusion is essentially to allow existing structures in perpetuity rather than requiring compliance with the expanded critical area buffers and structure setbacks, even upon redevelopment.

The ability to apply new buffers upon redevelopment was an assumption that affected some sections of the risk analysis, particularly conclusions about the Regulatory Alternative. These conclusions have been corrected in the descriptions of impacts provided in this addendum to the risk analysis.

3.0 Assumptions and Description of Alternatives

This chapter provides a summary of the Council-Modified Alternative analyzed in the final EIS for the proposed City of Bellevue critical areas update.

3.1 Council-Modified Alternative

The Council-Modified Alternative comprises several Land Use Code amendments for geologically hazardous areas, frequently flooded areas, streams and riparian areas, wetlands, shorelines, and wildlife habitat conservation areas.

3.1.1 All Critical Areas

The Council-Modified Alternative would be the same as the Regulatory Alternative, with the following modification:

- Tree pruning within a critical area buffer may be allowed as long as it is done in accordance with an approved vegetation management plan.

3.1.2 Geologically Hazardous Areas

The Council-Modified Alternative would be the same as the Regulatory Alternative, with the following modifications:

- The regulated area at the toe of slopes of 40 percent or greater as well as slopes with an identified landslide hazard would be classified as a 75-foot structure setback. (The 75-foot buffer as proposed in the Regulatory Alternative requires that existing vegetation at the toe of the slope be protected, while the 75-foot structure setback proposed for the Council-Modified Alternative does not.)
- Tree pruning may be allowed in geologic hazard areas and in required buffers on individual lots so long as it is done in accordance with the director's guidance.
- Tree topping would be allowed on individual lots where a tree has routinely been topped historically.

3.1.3 Frequently Flooded Areas

The standards under the Council-Modified Alternative would be the same as under the Regulatory Alternative.

3.1.4 Streams and Riparian Areas

On undeveloped lots under the Council-Modified Alternative, the restrictions on development or vegetation management within stream buffers would be the same as under the Regulatory Alternative, except that tree pruning could be allowed with an approved vegetation management plan. For example, along Type S streams a 100-foot buffer and a 20-foot structure setback would apply, so that a new structure would be at least 120 feet from the stream.

The Council-Modified Alternative would be the same as the Regulatory Alternative with the modifications shown in Table 3-1.

Table 3-1. Proposed and existing buffers for streams.

Washington State Stream Rating	Buffer under Regulatory Alternative and Council-Modified Alternative [a] (feet)	Buffer on Developed Lots under Council-Modified Alternative (feet)	Structure Setbacks on Developed Lots under Council-Modified Alternative	Buffer under Existing Bellevue Code (feet)
Type S	100	50	50	50
Type F	100	50	50	50–10
Type N	50	25	25	50–25
Type O	25	25	0	10–0

[a] In addition to the indicated buffer, a 10- to 20-foot structure setback would apply.

Under both the Regulatory Alternative and the Council-Modified Alternative, a new structure could be built within the footprint of an existing principal structure located within a buffer or structure setback, but the buffer and structure setback must wrap around the existing footprint so that the structure cannot be expanded into the buffer, unless mitigation is provided. Such mitigation typically takes the form of vegetation enhancement in the buffer.

On developed lots under the Council-Modified Alternative, the minimum distance between a new structure and a given stream type would be slightly less than under the Regulatory Alternative. For instance, along Type S streams, a 50-foot buffer and a 50-foot structure setback would apply, so that a new structure could be 100 feet from the stream, rather than at least 120 feet as required under the Regulatory Alternative.

In addition, unlike a buffer requirement, a structure setback does not limit the placement of new impervious surfaces. Although the total impervious surface allowed on an individual lot would be the same under the Council-Modified Alternative as under the Regulatory Alternative, impervious surfaces such as patios, driveways, sport courts, and surface parking could be located within the structure setback and thus could be up to 50 feet closer to the stream under the Council-Modified Alternative. Consequently, on developed lots the vegetation protected by buffer requirements under the Council-Modified Alternative would be approximately 50 percent of the area protected under the Regulatory Alternative, and at least some of the impervious surface allowed on a lot would be expected to be located within the structure setback.

An example may help to illustrate the difference between the Regulatory Alternative and the Council-Modified Alternative. A typical developed single-family residential lot in Bellevue is approximately 7,200 square feet in area. For this example, assume that the lot is 60 feet wide by 120 feet deep and adjacent to a Class S stream. The house typically occupies approximately 30 percent of the lot area, and driveways and walks providing access to the house occupy approximately another 10 percent. These features would be allowed to remain and could be replaced within their existing footprint under either alternative. Because the proposed limit on impervious surfaces is 50 percent of the lot area for most residential areas, on the typical lot the owners could add another 10 percent (720 square feet) of lot coverage with impervious surfaces. This additional impervious surface might be in the form of a patio, sport court, or surface parking.

Under the Regulatory Alternative, the owner of this lot would not be allowed to place new impervious surfaces within the 100-foot buffer adjacent to the stream. New impervious surfaces, such as patios, driveways, sport courts, and surface parking, would be allowed within the 20-foot structure setback adjacent to the buffer. The owners could add some of these types of features to the outer part of the buffer if they produce a mitigation stewardship plan that shows that the buffer functions lost by placing the new impervious surfaces would be replaced by some enhancement to the remaining buffer. If the area in question is lawn, the functions affected may be infiltration, runoff rate, pollutant attenuation, and/or water temperature regulation.

Under the Council-Modified Alternative, the new impervious surfaces could be placed as close as 50 feet to the stream, and there would be no requirement to mitigate these effects by enhancing the buffer. The 50-foot structure setback area would be 60 feet wide on the typical lot, and it is likely that the house would already occupy a portion of the setback (since approximately 64 percent of lots adjacent to streams were found to have structures closer than 100 feet to the stream [Bellevue 2006]). In this example, the additional impervious surface allowed represents approximately 24 percent of the setback area, and the remainder must remain pervious.

3.1.5 Wetlands

The Council-Modified Alternative would be the same as the Regulatory Alternative, with the following modifications:

- The definition of developed properties when used in relation to wetlands and wetland buffers would include only those properties where the wetlands and buffers are in a native growth projection area or easement. An undeveloped site would be any site where the wetland and wetland buffer have not previously been included within a native growth protection area (NGPA) or native growth protection easement (NGPE), regardless of whether the site contains a primary structure.

- On properties where a NGPE or NGPA has been previously approved and recorded, the required buffers would be defined in the NGPE or NGPA.

- Structure setbacks on developed properties where a NGPE or NGPA has been previously approved and recorded would be:

  - Category I or II– 20 feet from edge of NGPE or NGPA
  - Category III– 15 feet from edge of NGPE or NGPA
  - Category IV – None.

The effect of these modifications to the standards described in the Regulatory Alternative is that, on lots developed under current critical area regulations, the NGPE or NGPA required by code would remain the required buffer for the foreseeable future. Buffers have been protected through NGPEs and NGPAs primarily in subdivisions created since 1987. Such subdivisions with NGPEs and NGPAs are not expected to undergo significant rates of redevelopment within the near-term and long-term timeframes of this risk analysis. Therefore, the effect on wetland protection of this difference in protective buffers between the Regulatory and Council-Modified alternatives is not expected to be significant.

The Council-Modified Alternative would continue to allow reconstruction or remodeling within the footprint of existing primary structures that are noncomplying, as would the Regulatory Alternative. However, properties considered developed (because a primary structure is already present) but large enough to be subdivided would be subject to the revised buffer requirements applicable to undeveloped properties under the Council-Modified Alternative, because the larger buffer would apply to any new vacant lot created by the subdivision.

3.1.6 Shorelines

The Council-Modified Alternative would be the same as the Regulatory Alternative with the following modifications:

- On developed properties, the required buffer would be 25 feet from the ordinary high water mark.

- On developed properties, the structure setback would be 25 feet from the landward edge of the required buffer.

- The city would explore a pilot program to streamline permitting for docks in conjunction with federal and state permitting requirements.

On developed properties, therefore, structures must be at least 50 feet from the ordinary high water mark, and vegetation would be protected in the waterward 25-foot portion of that area. Although the total impervious surface allowed on an individual lot would be the same as allowed under the Regulatory Alternative, impervious surfaces such as patios, driveways, sport courts, and surface parking could be located within the structure setback and thus could be up to 25 feet closer to the shoreline than under the Regulatory Alternative. Therefore, on developed lots (which constitute most of the lots in the shoreline), the native vegetation protected by buffer

requirements under the Council-Modified Alternative would be approximately 50 percent of the area protected under the Regulatory Alternative, and at least some of the impervious surface allowed on a lot could be expected to be located within the structure setback.

An example using the typical developed single-family residential lot in Bellevue may help to illustrate the difference between the Regulatory Alternative and the Council-Modified Alternative. For this example, assume that the 7,200-square-foot lot is 60 feet wide by 120 feet deep and adjacent to a shoreline. The house typically occupies approximately 30 percent of the lot area, and driveways and walks providing access to the house occupy approximately another 10 percent. These features would be allowed to remain and could be replaced within their existing footprint under either alternative. Because the proposed limit on impervious surfaces is 50 percent of the lot area for most residential areas, on the typical lot the owners could add another 10 percent (720 square feet) of lot coverage with impervious surfaces. This additional impervious surface might be in the form of a patio, sport court, or surface parking.

Under the Regulatory Alternative, the owner of this lot would not be allowed to place the new impervious surfaces within the 50-foot buffer of the shoreline. The owners would be allowed to add some of these types of features to the outer part of the buffer if they produce a mitigation stewardship plan showing that the buffer functions lost by placing the new impervious surfaces would be replaced by some enhancement to the remaining buffer.

Under the Council-Modified Alternative, the new impervious surfaces could be placed as close as 25 feet to the shoreline, and there would be no requirement to mitigate these effects by enhancing the buffer. The 25-foot structure setback area would be 60 feet wide on the typical lot, and it is likely that the house would already occupy a portion of the setback (since approximately 60 percent of lots were found to have structures closer than 50 feet to the shoreline [Bedwell 2006]). In this example, the additional impervious surface allowed represents approximately 48 percent of the setback area, and the remainder must remain pervious.

3.1.7 Wildlife Habitat Conservation Areas

The standards specific to wildlife protection under the Council-Modified Alternative are the same as under the Regulatory Alternative. Both rely on protection of critical areas and buffers to protect wildlife habitat. However, because the Council-Modified Alternative would provide reduced buffer protection for streams and shorelines on developed property compared with the Regulatory Alternative, it would be less protective of wildlife habitat.

In addition, the Regulatory Alternative is more likely than the Council-Modified Alternative to produce a landscape with mature forested vegetation within buffer areas, because the Regulatory Alternative includes a stewardship option in which property owners could use some of the outer buffer area in exchange for enhancements in the inner buffer. This option is not included in the Council-Modified Alternative.

4.0 Environmental Conditions and Risk Analysis for Geologic Hazards and Frequently Flooded Areas

This chapter describes the analysis results related to protecting public health and safety within geological hazards and frequently flooded areas for the Council-Modified Alternative. The results of the analysis of risk to public health and safety conditions are summarized in Table 4-1.

4.1 Ground Shaking

Council-Modified Alternative: As with the Regulatory Alternative and City Programs Alternative, the Council-Modified Alternative would have a neutral effect on public health and safety in both the near term and the long term. The Council-Modified Alternative would maintain existing properly protected conditions.

4.2 Surface Rupture

Council-Modified Alternative: As with the Regulatory Alternative and City Programs Alternative, the Council-Modified Alternative would have a neutral effect on public health and safety in both the near term and the long term. The Council-Modified Alternative would tend toward not properly protected conditions and would result in continued degraded conditions.

4.3 Liquefaction

Council-Modified Alternative: As with the Regulatory Alternative and City Programs Alternative, the Council-Modified Alternative would have a neutral effect on public health and safety in both the near term and the long term. The Council-Modified Alternative would maintain existing properly protected conditions.

4.4 Tsunami and Seiche Hazards

Council-Modified Alternative: As with the Regulatory Alternative and City Programs Alternative, the Council-Modified Alternative would have a neutral effect on public health and safety in both the near term and the long term. The Council-Modified Alternative would maintain existing degraded conditions.

Table 4-1. Geologic hazards and frequently flooded areas: environmental conditions and risk analysis matrix.

Geologic Hazards and Indicators		Public Health and Safety Baseline Conditions		Risk Analysis Results															
				No-Action Alternative				Regulatory Alternative/ City Program Alternative				BAS Based Alternative				Council-Modified Alternative			
Hazard	Indicators	Properly Protected	Not Properly Protected	PPC	PPC	N	U	PPC	NPC	N	U	PPC	NPC	N	U	PPC	NPC	N	U
Ground Shaking	Construction standards	X				NT/ LT				NT/ LT				NT/ LT				NT/ LT	
Surface Rupture	Location of essential facilities		X			NT/ LT				NT/ LT		LT		NT				NT/ LT	
Liquefaction	Location of essential facilities	X				NT/ LT				NT/ LT				NT/ LT				NT/ LT	
Tsunami/ Seiche	Setback and construction standards		X			NT/ LT				NT/ LT		NT/ LT						NT/ LT	
Erosion	Soil loss and sedimentation		X		NT		LT	NT/ LT				NT/ LT					NT/ LT		
Landsliding	Setbacks from top and toe of steep slopes		X		NT/ LT							NT/ LT				NT/ LT			
Volcanic Eruption	Planning for impacts of an ash-fall event	X				NT/ LT				NT/ LT				NT/ LT				NT/ LT	
Coal Mines	Construction standards	X				NT/ LT				NT/ LT		NT/ LT						NT/ LT	
Flooding	Development standards	X				NT/ LT				NT		LT		NT		LT		NT	
	Floodway condition	X				NT/ LT				NT		LT		NT		LT		NT	
	Channel migration	X				NT/ LT				LT		LT		NT		NT		LT	

PPC: Tends toward properly protected condition.
NPC: Tends toward not properly protected condition.
N: Neutral.
U: Unknown.
NT: Near-term conditions (5 years).
LT: Long-term conditions (50 years).

4.5 Erosion

Council-Modified Alternative: The Council-Modified Alternative would tend toward not properly protected conditions in both the near term and the long term. The Council-Modified Alternative would maintain existing degraded conditions that are not protective of public health and safety in the near term and in the long term.

4.6 Landsliding

Council-Modified Alternative: The Council-Modified Alternative would be the same as under the Regulatory Alternative, with one modification: existing vegetation within a 75-foot structure setback from the toe of steep slopes would not be protected.

As with the Regulatory Alternative and City Programs Alternative, the Council-Modified Alternative would add a 75-foot setback at the toe of 40 percent or steeper slopes, promoting properly protected conditions in both the near term and the long term, but not offering the same degree of protection as the Regulatory Alternative or City Programs Alternative.

The Council-Modified Alternative would improve protection for public health and safety in the near term and the long term.

4.7 Volcanic Eruption

Council-Modified Alternative: As with the Regulatory Alternative and City Programs Alternative, the Council-Modified Alternative would have a neutral effect on public health and safety in both the near term and the long term. The Council-Modified Alternative would maintain existing properly protected conditions.

4.8 Coal Mines

Council-Modified Alternative: As with the Regulatory Alternative and City Programs Alternative, the Council-Modified Alternative would have a neutral effect on public health and safety in both the near term and the long term. The Council-Modified Alternative would maintain existing properly protected conditions.

4.9 Frequently Flooded Areas

4.9.1 Development Standards

Council-Modified Alternative: As with the Regulatory Alternative and City Programs Alternative, the Council-Modified Alternative would have a neutral effect on public health and

safety in the near term and would tend toward properly protected conditions in the long term. The Council-Modified Alternative would maintain existing properly protected conditions.

4.9.2 Floodway Conditions

Council-Modified Alternative: As with the Regulatory Alternative and City Programs Alternative, the Council-Modified Alternative would have a neutral effect on public health and safety in the near term and would tend toward properly protected conditions in the long term. The Council-Modified Alternative would maintain existing properly protected conditions.

4.9.3 Channel Migration

Council-Modified Alternative: As with the Regulatory Alternative and City Programs Alternative, the Council-Modified Alternative would tend toward properly protected conditions in the near term and would have a neutral effect on public health and safety in the long term. The Council-Modified Alternative would maintain existing properly protected conditions.

5.0 Environmental Conditions and Risk Analysis for Streams and Riparian Areas

This chapter provides a discussion of the analysis of the expected environmental risk associated with implementation of the Council-Modified Alternative for the city's proposed critical areas update. The risk analysis is based on best available science and includes an assessment of existing stream and riparian conditions and a comparison of the expected effects of the Council-Modified Alternative on existing conditions.

The Council-Modified Alternative would be the same as the Regulatory Alternative with the modifications shown in Table 2-1 (proposed and existing buffer streams). Given these modifications, it is expected that the Council-Modified Alternative would be less protective than the Regulatory Alternative. Therefore, under the Council-Modified Alternative there would be an increased risk to some ecological functions associated with implementation of the city's proposed critical areas update.

On developed lots under the Council-Modified Alternative, the minimum distance between a new structure and a given stream type would be slightly less than under the Regulatory Alternative. For instance, along Type S streams, a 50-foot buffer and a 50-foot structure setback would apply, so that a new structure could be 100 feet from the stream, rather than at least 120 feet as required under the Regulatory Alternative (see the description of the Council-Modified Alternative for a specific example).

Redevelopment scenarios under the No-Action Alternative may be more protective than under the Council-Modified Alternative for some stream segments, because the No-Action Alternative requires properties to comply with stream buffer regulations when certain thresholds of a structure's value are exceeded; whereas the Council-Modified Alternative allows all noncompliant primary structures to be reconstructed or remodeled within the same footprint. Although the buffer requirements of the No-Action Alternative are narrower, over time, more properties are likely to be required to comply with those buffers.

Areas that may see redevelopment exceeding the structure value thresholds will be determined by market forces and, in the foreseeable future, may include the Bellevue-Redmond area and Richards valley. Some of the Kelsey Creek headwaters lie within the Bellevue-Redmond corridor (the West Tributary and the unnamed tributary), and the No-Action Alternative could result in 10- to 50-foot buffers in those areas where no buffer currently exists. In the citywide picture the area affected is small, but buffers on these stream segments could provide a functional lift to the downstream portions of Kelsey Creek.

However, because experience shows that Bellevue property owners will stay under structure value thresholds in order to avoid having to comply with existing regulations (Berens et al. 2006), and areas that may meet the criteria for redevelopment in the foreseeable future represent a minority of properties located adjacent to creeks within the city, no substantial improvement to

stream protection is expected to result. Consequently, over time, the Council-Modified Alternative is expected to have effects similar to the No-Action Alternative for developed properties at the time of redevelopment.

Under both the Regulatory Alternative and the Council-Modified Alternative, existing primary structures could be reconstructed or remodeled within the same footprint. Consequently, little improvement in buffer protection would be expected in the absence of developer incentives such as an exchange for increased density.

5.1 Water Quality

5.1.1 Temperature

Council-Modified Alternative: As with the Regulatory Alternative, the temperature indicator under the Council-Modified Alternative would tend toward *not properly functioning* conditions and therefore would result in habitat degradation in both the near term and the long term.

The Council-Modified Alternative would allow an increase in some types of impervious surfaces. The total impervious surface allowed on an individual lot would be the same as allowed under the Regulatory Alternative. However, for stream Type S, impervious surfaces such as patios, driveways, sport courts, and surface parking could be located within the structure setback up to 50 feet closer to streams than the distance allowed on undeveloped lots.

Consequently, on developed lots the vegetation protected by buffer requirements under the Council-Modified Alternative would be approximately 50 percent of the area protected under the Regulatory Alternative, resulting in decreased opportunities for establishment of riparian vegetation (either natural growth or plantings by the property owner). Also, any increase in impervious surface area could result in cumulative adverse effects on stream water temperature.

5.1.2 Sediment and Turbidity

Council-Modified Alternative: As with the Regulatory Alternative, the sediment and turbidity indicator under the Council-Modified Alternative would tend toward *not properly functioning* conditions, and therefore would result in habitat degradation in both the near term and the long term. Unless actions are taken to address sediment sources or prevent fine sediments from entering receiving waters, sedimentation and turbidity would continue to affect city streams.

5.1.3 Chemical Contaminants and Nutrients

Council-Modified Alternative: As with the Regulatory Alternative, the chemical contaminants and nutrients indicator under the Council-Modified Alternative would tend toward *not properly functioning* conditions and therefore would result in habitat degradation in both the near term and the long term.

5.2 Habitat Access

5.2.1 Physical Barriers

Council-Modified Alternative: As with the Regulatory Alternative, the Council-Modified Alternative would maintain the current status of the physical barrier indicator. Therefore, the existing degraded conditions would persist over time in both the near term and the long term.

Neither the Regulatory Alternative nor the Council-Modified Alternative includes requirements for removal of existing fish passage barriers. These alternatives prohibit blocking of side channels by new development activity within natural watercourses (Land Use Code [LUC] 20.25H.180) and require compliance with fish and wildlife habitat conservation policies. Therefore, as with the Regulatory Alternative, physical barriers within the watershed would remain the same under the Council-Modified Alternative.

5.3 Habitat Element

5.3.1 Substrate

Council-Modified Alternative: As with the Regulatory Alternative, the substrate indicator under the Council-Modified Alternative would tend toward *not properly functioning* conditions in the near term and the long term. Given the extent of impervious cover in Bellevue streams and the associated high flows, it is likely that native substrate would continue to be altered by erosion and sedimentation.

Therefore, the Council-Modified Alternative would degrade habitat conditions in both the near term and the long term. Conditions for this indicator would continue to be degraded without actions taken to return erosion and sediment transport processes to a natural equilibrium. Moreover, because impervious surfaces could be located within the structure setback, and thus could be up to 50 feet closer to a stream (for Type S streams) than under the Regulatory Alternative, the Council-Modified Alternative has greater potential to degrade this indicator in the long term.

5.3.2 Large Woody Debris

Council-Modified Alternative: As with the Regulatory Alternative, the large woody debris indicator would tend toward *not properly functioning* conditions under the Council-Modified Alternative and therefore would result in habitat degradation in both the near term and the long term.

The Council-Modified Alternative would provide protection for woody debris recruitment from existing forested areas by means of structure setbacks (10 to 20 feet) and riparian buffers (100 feet for Type S streams; 100 feet for Type F streams; 50 feet for Type N streams; and 25 feet for Type O streams). However, on developed properties, the Council-Modified

Alternative would degrade the large woody debris indicator, because forested areas and the quantity of large woody debris within riparian areas are not expected to increase. In addition, riparian areas within the city typically are developed and hence are not expected to contribute significant woody debris to stream channels or increase the number of wood pieces within streams.

On developed lots, the vegetation protected by buffer requirements under the Council-Modified Alternative would be approximately 50 percent of the area protected under the Regulatory Alternative (assuming that some native trees and shrubs exist). However, the Regulatory Alternative would not improve the large woody debris indicator because the quantity of large woody debris within riparian areas is not expected to increase. Riparian areas within the city are typically developed and are not expected to contribute significant woody debris to the stream channel or increase the number of wood pieces within streams. Also, although a 50-foot structure setback would apply under the Council-Modified Alternative, tree pruning and removal would be allowed. Furthermore, unlike the buffer requirement, the structure setback does not limit the placement of certain types of new impervious surfaces.

5.3.3 Pool Frequency

Council-Modified Alternative: As with the Regulatory Alternative, the pool frequency indicator under the Council-Modified Alternative would tend toward *not properly functioning* conditions in the near term and the long term. Therefore, the Regulatory Alternative would degrade existing habitat conditions, for the same reason given above for the large woody debris indicator. Under the Council-Modified Alternative, streams would continue to have high discharge flows resulting from stormwater runoff, which—combined with the lack of large woody debris—has the potential to reduce the frequency of pools.

5.3.4 Pool Quality

Council-Modified Alternative: Under the Council-Modified Alternative, the pool quality indicator would tend toward *not properly functioning* conditions, and therefore would result in habitat degradation in both the near term and the long term. Pool quality is directly related to abundance of large woody debris. As previously stated, the large woody debris indicator would be degraded under the Council-Modified Alternative.

With an approved vegetation management plan, tree pruning could be allowed in both the near term and the long term, potentially decreasing the existing and future woody debris recruitment potential from existing developed lots. Therefore, compared to existing conditions, pool quality is likely to be degraded under the Council-Modified Alternative.

5.3.5 Off-Channel Habitat

Council-Modified Alternative: As with the Regulatory Alternative, the Council-Modified Alternative would maintain the current status of the off-channel habitat indicator in both the near

term and the long term. As with the Regulatory Alternative, the Council-Modified Alternative would require the avoidance of development that blocks side channels (LUC 20.25H.180.C5).

5.3.6 Refugia

Council-Modified Alternative: As with the Regulatory Alternative, the Council-Modified Alternative would maintain the current status of the refugia indicator in both the near term and the long term.

Although on developed lots the vegetation protected by buffer requirements under the Council-Modified Alternative would be approximately 50 percent of the area protected under the Regulatory Alternative, on undeveloped lots the required setbacks and buffers would limit removal of existing riparian vegetation for new development.

5.4 Channel Condition and Dynamics

5.4.1 Width/Depth Ratio

Council-Modified Alternative: As with the Regulatory Alternative, the width/depth ratio indicator under the Council-Modified Alternative would tend toward *not properly functioning* conditions, and therefore would degrade existing habitat conditions in both the near term and the long term. Increased setbacks are not expected to prevent bank erosion or incised reaches resulting from high peak flows. Unlike the buffer requirement, the structure setback does not limit the placement of certain types of new impervious surfaces, which may result in increased stream bank erosion.

5.4.2 Stream Bank Conditions

Council-Modified Alternative: Under the Council-Modified Alternative, the stream bank conditions indicator would tend toward *not properly functioning* conditions, and therefore would degrade existing habitat conditions in both the near term and the long term. Increased setbacks are not expected to prevent bank erosion or incised stream reaches resulting from high peak flows. Unlike the buffer requirement, the structure setback does not limit the placement of certain types of new impervious surfaces, which may result in increased stream bank erosion. Furthermore, although a 50-foot structure setback would apply, tree pruning could be allowed with an approved vegetation management plan.

5.4.3 Floodplain Connectivity

Council-Modified Alternative: As with the Regulatory Alternative, the Council-Modified Alternative would maintain the current status of the floodplain connectivity indicator in the near term and the long term. Minimal new development within riparian and floodplain areas would occur under the Council-Modified Alternative, as it is unlikely that new roads or major development would be built within valley bottoms under this alternative.

5.5 Flow and Hydrology

5.5.1 Change in Peak and Base Flows

Council-Modified Alternative: The Council-Modified Alternative would degrade the current status of the peak/base flow indicator in the near term and the long term. Increased setbacks are not expected to prevent episodes of bank high peak flows. Unlike the buffer requirement, the structure setback does not limit the placement of certain types of new impervious surfaces, which may result in increased stream bank erosion. Furthermore, although a 50-foot structure setback would apply, tree pruning could be allowed with an approved vegetation management plan.

5.5.2 Increase in Drainage Network

Council-Modified Alternative: As with the Regulatory Alternative, under the Council-Modified Alternative the risk to the current status of the drainage network indicator is unknown in the near term and the long term. The Council-Modified Alternative does not address changes in the existing drainage network.

5.6 Watershed Conditions

5.6.1 Road Density and Location

Council-Modified Alternative: As with the Regulatory Alternative, the Council-Modified Alternative would maintain the current status of the road density and locations indicator in the near term and the long term. Minimal new development within riparian and floodplain areas would occur under the Council-Modified Alternative. The existing conditions of the indicator are expected to be maintained because it is unlikely that new roads or major development would be built within valley bottoms under this alternative.

5.6.2 Disturbance History

Council-Modified Alternative: The Council-Modified Alternative would maintain the current *not properly functioning* status of the disturbance history indicator in the near term and the long term.

On developed lots the vegetation protected by buffer requirements under the Council-Modified Alternative would be approximately 50 percent of the area protected under the Regulatory Alternative. However, on undeveloped lots, setbacks and buffers would limit the removal of existing riparian vegetation for new development.

5.6.3 Riparian Reserves

Council-Modified Alternative: As with the Regulatory Alternative, the Council-Modified Alternative would maintain the existing status of the riparian reserves indicator in the near term and the long term, for the same reasons given above for the disturbance history indicator.

5.6.4 Natural Disturbances

Council-Modified Alternative: As with the Regulatory Alternative, under the Council-Modified Alternative the risk to the current status of the natural disturbance indicator is unknown in the near term and the long term. Existing development within the watershed is likely to continue impeding habitat-forming processes associated with natural disturbances. The Council-Modified Alternative does not address natural disturbances; therefore, the risk to existing conditions for the natural disturbance indicator is unknown.

5.6.5 Total Impervious Area

Council-Modified Alternative: Under the Council-Modified Alternative, the risk to the current status of the total impervious area indicator is unknown in the near term and the long term. Although under the Regulatory Alternative the baseline conditions for total impervious area would remain unchanged or increase slightly with the impervious surface area limits added to the city Land Use Code, the Council-Modified Alternative's structure setback does not limit the placement of new impervious surfaces of certain types (e.g., patios). It allows impervious surfaces to be located closer to the critical resource on developed lots by cutting the buffer width in half, making the upper remainder of the buffer the structure setback, and allowing impervious surfaces such as patios, driveways, sport courts, and surface parking within the structure setback. The Council-Modified Alternative is expected to continue the degradation of existing conditions in the near term and the long term.

5.6.6 Riparian Breaks

Council-Modified Alternative: The Council-Modified Alternative would maintain the existing status of the riparian breaks indicator in the near term, but would degrade this indicator in the long term. Under both the Regulatory Alternative and the Council-Modified Alternative, a new structure could be built within the footprint of an existing principal structure located within a buffer or structure setback. However, the buffer and structure setback would wrap around the existing footprint so that the structure could not be expanded into the buffer, unless mitigation is provided, typically in the form of vegetation enhancement in the buffer.

Land use regulations establishing setbacks are based on stream typing. On undeveloped lots under the Council-Modified Alternative, the restrictions on development or vegetation management within stream buffers would be the same as under the Regulatory Alternative, except that tree pruning could be allowed with an approved vegetation management plan. For example, along Type S streams a 100-foot buffer and a 20-foot structure setback would apply, requiring a new structure to be located at least 120 feet from the stream.

On developed lots under the Council-Modified Alternative, the minimum distance between a structure and a given stream type would be slightly less. For example, on lots where a full 100 feet of unobstructed buffer and setback already exists, along Type S streams, a 50-foot buffer and a 50-foot structure setback would apply, requiring a new structure to be at least 100 feet from the stream, rather than 120 feet as required under the Regulatory Alternative.

In addition, unlike the buffer requirement, the structure setback does not limit the placement of new impervious surfaces. Although the total impervious surface allowed on an individual lot would be the same as allowed under the Regulatory Alternative, impervious surfaces such as patios, driveways, sport courts, and surface parking could be located within the structure setback, and thus could be up to 50 feet closer to the stream (for Type S streams) than under the Regulatory Alternative.

5.7 Conclusion

Many indicators of existing environmental conditions in Bellevue streams are *not properly functioning*, according to the NMFS (1996) criteria and based on best available science (Bellevue 2003; Herrera 2005a). The risk analysis performed for the proposed critical areas update (Herrera 2005b) indicates that as with the Regulatory, City Programs, and BAS Based alternatives, the Council-Modified Alternative would not change the trend toward a positive or restorative direction for all of the indicators (Table 5-1).

Consequently, as with the other alternatives, the overall stream conditions would continue to degrade in the near term and the long term under the Council-Modified Alternative. Some combination of alternatives or the implementation of programs targeted to address existing at-risk conditions would be required in order to maintain or improve stream and riparian area indicators.

Table 5-1. Streams: environmental conditions and risk analysis matrix.

Pathways and Indicators		Existing Environmental Baseline Conditions			Risk Analysis Results																			
					No-Action Alternative				Regulatory Alternative				City Programs Alternative				Best Available Science (BAS) Based Alternative				Council-Modified Alternative			
Pathway	Indicators	Properly Functioning	At Risk	Not Properly Functioning	PFC	NPC	N	U	PFC	NPC	N	U	PFC	NPC	N	U	PPC	NPC	N	U	PPC	NPC	N	U
Water Quality:	Temperature		X			NT/ LT				NT/ LT			LT	NT			LT	NT				NT/ LT		
	Sediment/turbidity			X		NT/ LT				NT/ LT				NT/ LT			LT	NT				NT/ LT		
	Chemical contamination or excess nutrients		X			NT/ LT				NT/ LT				NT/ LT			LT	NT				NT/ LT		
Habitat Access:	Physical barriers			X			ST/ LT				NT/ LT		LT		NT		LT	NT					NT/ LT	
Habitat Elements:	Substrate		X			NT/ LT				NT/ LT				NT/ LT				NT/ LT				NT/ LT		
	Large woody debris			X		NT/ LT				NT/ LT			NT/ LT				NT/ LT					NT/ LT		
	Pool frequency			X		NT/ LT				NT/ LT				NT/ LT			NT/ LT					NT/ LT		
	Pool quality [a]			X		NT/ LT					NT/ LT		NT/ LT				NT/ LT					NT/ LT		
	Off-channel habitat		X				NT/ LT				NT/ LT		LT		NT		LT		NT				NT/ LT	
	Refugia (important remnant habitat for sensitive aquatic species) [a]		X			NT/ LT					NT/ LT		LT		NT		LT		NT				NT/ LT	
Channel Condition & Dynamics:	Width/depth ratio	X				NT/ LT				NT/ LT					NT/ LT				NT/ LT			NT/ LT		
	Stream bank condition			X				NT/ LT				ST/ LT			NT/ LT				NT/ LT			NT/ LT		
	Floodplain connectivity		X			NT/ LT					NT/ LT		LT		NT		LT		NT				NT/ LT	

Table 5-1 (continued). Streams: environmental baseline and risk analysis matrix.

Pathways and Indicators		Existing Environmental Baseline Conditions			Risk Analysis Results																			
					No-Action Alternative				Regulatory Alternative				City Programs Alternative				Best Available Science (BAS) Based Alternative				Council-Modified Alternative			
Pathway	Indicators	Properly Functioning	At Risk	Not Properly Functioning	PFC	NPC	N	U	PFC	NPC	N	U	PFC	NPC	N	U	PPC	NPC	N	U	PPC	NPC	N	U
Flow/ Hydrology:	Change in peak/base flows			X		NT/ LT					NT/ LT					NT/ LT				NT/ LT		NT/ LT		
	Increase in drainage network [a]			X				NT/ LT				NT/ LT				NT/ LT				NT/ LT				NT/ LT
Watershed Conditions:	Road density & location [a]			X			NT/ LT				NT/ LT				NT/ LT				NT/ LT				NT/ LT	
	Disturbance history[a]			X		NT/ LT			LT		NT			NT/ LT			LT		NT				NT/ LT	
	Riparian reserves			X		NT/ LT					NT/ LT			NT/ LT				NT		LT			NT/ LT	
	Natural disturbances		X					NT/ LT				NT/ LT				NT/ LT				NT/ LT				NT/ LT
	Total impervious area			X		NT/ LT					NT/ LT			NT/ LT				NT		LT				NT/ LT
	Riparian breaks		X			NT/ LT					NT/ LT			NT/ LT				NT		LT			NT	LT

Source: Adapted from *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (NMFS 1996).
Notes:
[a] Watershed-scale data are limited; therefore data at the reach scale may be used for risk analysis.
NT: Near-term conditions (5 years).
LT: Long-term conditions (50 years).
PFC: Tends toward properly functioning condition.
NPC: Tends toward not properly functioning condition.
N: Neutral.
U: Unknown.
X: Existing condition.

6.0 Environmental Conditions and Risk Analysis for Wetlands

This chapter provides a discussion of the environmental conditions and an analysis of the expected environmental risk associated with implementation of the Council-Modified Alternative for updating critical areas protection for wetlands in the City of Bellevue.

The Council-Modified Alternative would be the same as the Regulatory Alternative, with the modifications discussed in Chapter 3. One substantial difference between the Council-Modified Alternative and the Regulatory Alternative is that under the Council-Modified Alternative, for developed properties where a native growth protection easement (NGPE) or a native growth protection agreement (NGPA) has been previously approved and recorded, the required buffers would be defined by the NGPE or NGPA and not by the current regulations. Under both alternatives, primary structures located within a sensitive area or its buffer could be reconstructed or remodeled within the same footprint.

For most indicators of ecological function, the Council-Modified Alternative would improve wetland conditions in the long term compared to the No-Action Alternative, largely because remaining undeveloped areas would be subject to revised wetland buffer requirements.

The NGPA and NGPE buffer modifications to the Regulatory Alternative are expected to have a minimal effect on wetland protection. Within the timeframe covered by this analysis, there is a small likelihood that properties conditioned with NGPEs or NGPAs would be redeveloped and therefore subject to the Council-Modified Alternative requirements for wider wetland buffers. Given the scope of the modifications and prevailing land use patterns, it is expected that the Council-Modified Alternative would be equally protective compared to the Regulatory Alternative and more protective than the No-Action Alternative.

Redevelopment scenarios under the No-Action Alternative may be more protective than under the Council-Modified Alternative for certain land uses, because properties are required to comply with wetland buffer regulations when certain thresholds for structure value are exceeded; whereas the Council-Modified Alternative allows all noncompliant primary structures to be reconstructed or remodeled within the same footprint. So, theoretically, although the buffer requirements of the No-Action Alternative are smaller, over time more properties are likely to be required to comply with those buffers in areas where no buffer currently exists.

Experience shows that Bellevue property owners will stay under structure value thresholds in order to avoid having to comply with existing regulations (Berens et al. 2006). Because that trend would be expected to continue under the No-Action Alternative, in actuality only a small number of properties are likely to meet the redevelopment thresholds. Properties likely to meet these thresholds are commercial properties in areas where market forces direct a significant change in use that trigger the thresholds. Areas that may meet the criteria for redevelopment in the foreseeable future include the Bellevue-Redmond corridor and Richards valley. Because these areas represent a minority of properties located adjacent to wetlands within the city, no

measurable improvement to wetland protection is expected to result. Consequently, overall the Council-Modified Alternative is expected to improve conditions over the No-Action Alternative.

The criteria used for this risk analysis were adapted for wetlands from *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (NMFS 1996).

The results of the risk analysis for the Council-Modified Alternative are discussed below for each pathway and its associated indicators.

6.1 Water Regime

6.1.1 Average Water Level Fluctuation

Council-Modified Alternative: As with the Regulatory Alternative, the Council-Modified Alternative would rely on increasing buffer widths and improving the standards for allowed alterations to wetlands and buffers, as well as mitigation ratios and requirements. New limits on impervious surfaces and incentives for using low-impact development practices would be implemented. The Council-Modified Alternative would improve properly functioning conditions in the long term as redevelopment occurs but not in the near term due to past development practices. The Council-Modified Alternative would improve protection for wetland functions in the long term and would result in continued degradation in the near term.

6.1.2 Watershed Impervious Area

Council-Modified Alternative: As with the Regulatory Alternative, the Council-Modified Alternative would implement new limits on impervious surfaces and incentives for using low-impact development practices. The Council-Modified Alternative would improve properly functioning conditions in the long term as redevelopment occurs but not in the near term due to past development practices. The Council-Modified Alternative would improve protection for wetland functions in the long term and would continue degraded conditions in the near term.

6.2 Water Quality

Council-Modified Alternative: The Council-Modified Alternative would affect wetland water quality in the same way as the Regulatory Alternative, because both would impose increased performance standards for runoff discharged to wetlands. The Council-Modified Alternative would maintain the *not properly functioning* status of the water quality indicators in the near term and would improve properly functioning conditions for some water quality measures in the long term. The Council-Modified Alternative would continue to degrade protection for wetland functions in the near term for all water quality parameters and would improve protection in the long term for total phosphorus, total suspended solids, and zinc.

6.3 Habitat

6.3.1 Coverage of Nonnative Species

Council-Modified Alternative: As with the Regulatory Alternative, the Council-Modified Alternative would create an allowed use for habitat enhancement projects in buffers and setbacks for wetlands. The use of supplemental planting would be revised to allow for habitat enhancement and to support critical area improvement projects, subject to performance standards. Property owners would be able to suggest improvements to wetlands and buffers, such as enhancing native vegetation in return for increased flexibility in the amount of development allowed outside the wetland and its buffer.

The Council-Modified Alternative would maintain the *not properly functioning* condition of the nonnative species indicator in the near term, although there may be some improvement in the long term as landowners seek to develop more of their property. The Council-Modified Alternative would maintain existing conditions in the near term and improve them in the long term.

6.3.2 Wetland Area

Council-Modified Alternative: On undeveloped properties, the Council-Modified Alternative would increase buffer widths, increase setbacks, continue to allow enhancement of wetlands as mitigation for permanent losses (only in conjunction with wetland creation or restoration), allow modifications to wetlands and buffers under restricted conditions, and increase wetland mitigation requirements. Existing primary structures on developed properties would be allowed to be reconstructed or remodeled within the existing structure footprint.

The Council-Modified Alternative would maintain the *not properly functioning* status of the wetland area indicator in the near term and the long term, because losses of small wetlands would still be permitted, although potentially at a lower rate. The Council-Modified Alternative would continue to remove wetland habitat through development practices and therefore would incrementally degrade the extent of remaining wetland habitat.

6.3.3 Area of Upland Habitat Adjacent to a Wetland

Council-Modified Alternative: On undeveloped properties, the Council-Modified Alternative would increase buffer widths based on wetland functions and would allow modifications to wetlands and buffers under restricted conditions where a clear improvement in functions is shown.

The Council-Modified Alternative would maintain the *not properly functioning* status of the area of upland habitat adjacent to a wetland in the near term and would improve it in the long term, because redevelopment would be subject to revised wetland buffer requirements. The Council-Modified Alternative would maintain existing degraded conditions in the near term and improve them in the long term.

6.4 Physical Modifications

6.4.1 Acres of Wetlands Filled

Council-Modified Alternative: As with the Regulatory Alternative, the Council-Modified Alternative would continue to allow filling of wetlands provided that the losses are at least partially mitigated by wetland creation or restoration. The Council-Modified Alternative would maintain the *not properly functioning* status of the wetland fill indicator in the near term and the long term, because losses of small wetlands would still be permitted, although potentially at a lower rate. The Council-Modified Alternative would continue to remove wetland habitat through development practices and therefore further degrade the extent of the city's wetland habitats in the near term and the long term.

6.5 Conclusions

Table 6-1 summarizes the effect of each alternative on the wetland indicators used to characterize existing conditions and provides a comparison among all the alternatives including the Council-Modified Alternative.

Table 6-1. Wetlands: environmental conditions and risk analysis matrix.

Pathways and Indicators		Existing Environmental Conditions			Risk Analysis Results																			
					No-Action Alternative				Regulatory Alternative				City Programs Alternative				Best Available Science (BAS) Based Alternative				Council-Modified Alternative			
Pathways	Indicators	Properly Functioning	At Risk	Not Properly Functioning	PFC	NPC	N	U	PFC	NPC	N	U	PFC	NPC	N	U	PFC	NPC	N	U	PFC	NPC	N	U
Water Regime	Average water level fluctuation			X		NT/ LT			LT		NT		LT		NT		LT		NT		LT		NT	
	Watershed impervious area			X		NT/ LT			LT		NT		LT		NT		LT		NT		LT		NT	
Water Quality	Conductivity	X				NT/ LT					NT/ LT				NT/ LT				NT/ LT				NT/ LT	
	Total phosphorus		X			NT/ LT			LT		NT		NT/ LT				NT/ LT				LT		NT	
	Total suspended solids	X				NT/ LT			LT		NT		NT/ LT				NT/ LT				LT		NT	
	Ammonia (NH_3-N)		X			NT/ LT					NT/ LT				NT/ LT				NT/ LT				NT/ LT	
	Zinc			X		NT/ LT			LT		NT		NT/ LT				NT/ LT				LT		NT	
Habitat	Coverage of nonnative species		X			NT/ LT			LT	NT											LT	NT		
	Wetland area (acres)			X		NT/ LT					NT/ LT		LT		NT			NT	LT				NT/ LT	
	Area of upland habitat adjacent to a wetland			X		NT/ LT			LT		NT		LT		NT		LT		NT		LT		NT	
Physical Modifications	Acres of wetlands filled			X		NT/ LT				NT/ LT			LT		NT		NT/ LT					NT/ LT		

PFC: Tends toward properly functioning condition.
NPC: Tends toward not properly functioning condition.
N: Neutral.
U: Unknown.
NT: Near-term conditions (5 years).
LT: Long-term conditions (50 years).
X: Existing condition.

7.0 Environmental Conditions and Risk Analysis for Shorelines

This chapter provides a discussion of shoreline environmental conditions and an analysis of the expected risk to shorelines associated with implementation of the Council-Modified Alternative for updating critical areas protection in Bellevue.

The Council-Modified Alternative would be the same as the Regulatory Alternative, with the modifications discussed in Chapter 3. Given these modifications, it is expected that the Council-Modified Alternative would be less protective in some areas. Therefore, under the Council-Modified Alternative there would be an increased risk to some ecological functions associated with the implementation of the city's proposed critical areas update.

For example, although the total impervious surface allowed on an individual lot would be the same as allowed under the Regulatory Alternative, impervious surfaces such as patios, driveways, sport courts, and surface parking could be located in the structure setback and thus could be up to 25 feet closer to the shoreline than under the Regulatory Alternative. Hence, on developed lots (which constitute most of the lots in the shoreline) the native vegetation protected by buffer requirements under the Council-Modified Alternative would be approximately 50 percent of the area protected under the Regulatory Alternative. In addition, there would be no requirement to mitigate these effects by enhancing the buffer.

The results of the risk analysis for the Council-Modified Alternative are discussed below for each pathway and associated indicators.

7.1 Water Quality

7.1.1 Temperature/Dissolved Oxygen

Council-Modified Alternative: As with the Regulatory Alternative, the temperature/dissolved oxygen indicator under the Council-Modified Alternative would tend toward *not properly functioning* conditions, and therefore would degrade existing habitat conditions in the near term.

In the long term, the effect of the Council-Modified Alternative on the temperature indicator is unknown, although further degradation of existing conditions could result. In large stratified lakes such as Lake Washington and Lake Sammamish, water temperature is likely to be regulated primarily by air temperature and the temperature of stream tributary inputs.

On developed lots, the Council-Modified Alternative would allow an increase in some types of impervious surfaces, such as patios, driveways, sport courts, and surface parking, within structure setbacks from streams. This would decrease opportunities for the establishment of riparian vegetation, and could result in cumulative adverse effects on stream temperature and, in turn, lake water temperature.

7.1.2 pH

Council-Modified Alternative: As with the Regulatory Alternative, the pH indicator under the Council-Modified Alternative would tend toward *not properly functioning* conditions and therefore, would degrade the existing habitat conditions in both the near term and the long term. The Council-Modified Alternative would not restore riparian functions that could help to moderate pH values in streams and lakes.

7.1.3 Chemical Contaminants

Council-Modified Alternative: As with the Regulatory Alternative, the chemical contaminant indicator under the Council-Modified Alternative would tend toward *not properly functioning* conditions, and therefore would degrade existing habitat conditions in the near term.

Although in the long term the risk of implementing the Regulatory Alternative is unknown, conditions could degrade under implementation of the Council-Modified Alternative. The Council-Modified Alternative would allow an increase in some types of impervious surfaces, such as patios, driveways, sport courts, and surface parking, within stream structure setbacks (primarily on developed lots). This would decrease opportunities for the natural growth or planting of vegetation and could result in cumulative adverse effects on stream water quality and, in turn, lake water quality.

7.1.4 Nutrients/Total Phosphorus

Council-Modified Alternative: As with the Regulatory Alternative, the nutrients/total phosphorus indicator would tend toward *not properly functioning* conditions under the Council-Modified Alternative, and therefore would degrade the existing habitat conditions in both the near term and the long term.

The predominant existing shoreline vegetation within the city does not provide adequate water quality functions to eliminate or significantly minimize the introduction of nutrients and total phosphorus to lakes. The Council-Modified Alternative does not include restoration of shoreline riparian areas.

7.2 Habitat Access

7.2.1 Physical Barriers

Council-Modified Alternative: As with the Regulatory Alternative, the Council-Modified Alternative would maintain the current status of the physical barrier indicator, and therefore the existing degraded conditions would persist over time in both the near term and the long term. The Council-Modified Alternative does not require removal of existing fish passage barriers.

7.3 Habitat Element

7.3.1 Nonnative Species (In-Water Plants and Animals)

Council-Modified Alternative: As with the Regulatory Alternative, the nonnative species indicator would tend toward *not properly functioning* conditions under the Council-Modified Alternative, and therefore would degrade existing habitat conditions in both the near term and the long term. The proposed new regulations do not address removal or control of existing invasive, nonnative aquatic plant and fish species.

7.3.2 Shoreline Upwelling

Council-Modified Alternative: As with the Regulatory Alternative, the Council-Modified Alternative is not expected to affect the shoreline upwelling indicator; therefore the near-term and long-term effects are unknown.

7.3.3 Overhanging Vegetation

Council-Modified Alternative: As with the Regulatory Alternative, the overhanging vegetation indicator would tend toward *not properly functioning* conditions under the Council-Modified Alternative. Therefore, the Council-Modified Alternative would degrade habitat conditions in both the near term and the long term, for the same reasons discussed above under the water quality indicators.

7.3.4 Substrate Composition

Council-Modified Alternative: As with the Regulatory Alternative, the substrate composition indicator would tend toward *not properly functioning* conditions under the Council-Modified Alternative, and therefore would degrade existing habitat conditions in both the near term and the long term.

Bulkheads can have an adverse effect on substrate composition. Approximately 60 percent of Lake Washington lots and 55 percent of Lake Sammamish lots currently have bulkheads. At present, a great percentage of these bulkheads are located below the ordinary high water mark (82 percent in Lake Washington and 30 percent in Lake Sammamish) (Bellevue 1999).

Under the both the Regulatory Alternative and the Council-Modified Alternative, new bulkheads would be allowed only for the protection of existing residences located at or within 25 feet of the shoreline. About 40 percent of Lake Washington and Lake Sammamish lots meet this criterion (Bedwell 2006). In addition, the new code would require property owners to demonstrate that natural solutions (e.g., woody debris and planting) are not feasible before allowing concrete or rockery bulkheads. However, minor repair and maintenance of existing nonconforming bulkheads would still be allowed. It is likely that many of the existing bulkheads would remain at their present locations with implementation of only minor repairs. The Council-Modified Alternative does not require the removal of contaminated sediments.

Consequently, as with the Regulatory Alternative, the Council-Modified Alternative would continue to allow construction of new bulkheads and repair of existing bulkheads. Construction of new bulkheads could be permitted on a great percentage of lots with primary structures currently located more than 50 feet from the ordinary high water mark of these lakes.

7.3.5 Large Woody Debris

Council-Modified Alternative: As with the Regulatory Alternative, the large woody debris indicator would tend toward *not properly functioning* conditions under the Council-Modified Alternative, and therefore would degrade existing habitat conditions in both the near term and the long term.

Under the Council-Modified Alternative, the standards for shoreline development associated with residential docks are consistent with the U.S. Army Corps of Engineers regional general permit guidance. The regional general permit (USACE undated) requires the planting of a 10-foot-wide buffer along the entire length of a shoreline property that constructs a new dock or maintains an existing dock. Also, the regional general permit requires large woody debris to be retained at sites proposed for dock construction. This could improve localized lake riparian conditions and provide for long-term large woody debris recruitment. However, these measures are not expected to substantially alter this indicator in the near term or the long term.

7.4 Shoreline Conditions

7.4.1 Shoreline Vegetation, Riparian Structure, and Total Impervious Area

Council-Modified Alternative: As with the Regulatory Alternative, this indicator would tend toward *not properly functioning* conditions under the Council-Modified Alternative, and therefore would degrade existing habitat conditions in both the near term and the long term.

Under the Council-Modified Alternative, the total impervious area would continue to increase, even with the addition of the proposed amendments to LUC 20.25E, which require minimization of impervious surfaces within critical areas and critical area buffers. Also, the Council-Modified Alternative would allow an increase in some types of impervious surfaces, such as patios, driveways, sport courts, and surface parking, within structure setbacks from lakes.

7.4.2 Shoreline Profile

Council-Modified Alternative: As with the Regulatory Alternative, the shoreline profile indicator would tend toward not properly functioning conditions under the Council-Modified Alternative, and therefore would degrade existing habitat conditions in both the near term and the long term.

Although it is more restrictive than the Regulatory Alternative in some provisions, the Council-Modified Alternative would continue to allow construction of new bulkheads and repair of

existing bulkheads (see Substrate Composition section). Approximately 60 percent of Lake Washington lots and 55 percent of Lake Sammamish lots currently have bulkheads. At present, a great percentage of these bulkheads are located below the ordinary high water mark (82 percent in Lake Washington and 30 percent in Lake Sammamish) (Bellevue 1999). The new regulations would not require the removal of existing bulkheads.

7.4.3 Shoreline Ambient Light

Council-Modified Alternative: As with the Regulatory Alternative, the shoreline ambient light indicator would tend toward *not properly functioning* conditions under the Council-Modified Alternative, and therefore would degrade existing habitat conditions in both the near term and the long term.

Under both the Regulatory Alternative and the Council-Modified Alternative, existing docks would be allowed to remain, and minor repairs would be allowed. The recommended amendments establish a threshold beyond which prescriptive standards are applicable for more significant repairs. The standards are consistent with the U.S. Army Corps of Engineers regional general permit guidance (USACE undated).

Also, because techniques associated with dock maintenance and repair involve work in the water, the U.S. Army Corps of Engineers and Washington Department of Fish and Wildlife would have permitting authority and would likely impose mitigation requirements.

Although the standards in the regional general permit (USACE undated) would apply, (typically minimizing the permitted structure size), there would continue to be incremental increases in dock structures and over-water coverage.

7.5 Conclusion

Under existing conditions, the ecological functions of Bellevue shorelines are not properly functioning or are functioning at risk, according to the NOAA Fisheries (2003) criteria and based on best available science (Bellevue 2003; Herrera 2005a).

The shoreline risk analysis performed for the proposed Bellevue critical areas update indicates that as with the Regulatory, City Programs, and BAS Based alternatives, the Council-Modified Alternative would not change the trend toward a positive or restorative direction for all of the indicators (Table 7-1). Consequently, as with the other alternatives, in the near term and the long term, overall shoreline conditions would continue to degrade under the Council-Modified Alternative.

Only a combination of alternatives or the implementation of targeted programs could maintain or improve Bellevue's shoreline area indicators and, in turn, ecological functions.

Table 7-1. Shorelines: environmental conditions and risk analysis matrix.

Pathways and Indicators		Existing Environmental Baseline Conditions			Risk Analysis Results																			
					No-Action Alternative				Regulatory Alternative				City Programs Alternative				Best Available Science (BAS) Based Alternative				Council-Modified Alternative			
Pathway	Indicators	Properly Functioning	At Risk	Not Properly Functioning	PFC	NPC	N	U	PFC	NPC	N	U	PFC	NPC	N	U	PFC	NPC	N	U	PFC	NPC	N	U
Water Quality	Temperature/ dissolved oxygen			X		NT/ LT				NT		LT	LT	NT			LT	NT				NT/ LT		
	pH		X			NT/ LT				NT/ LT				NT		LT		NT		LT		NT/ LT		
	Chemical contamination		X			NT/ LT				NT		LT		NT/ LT			LT	NT				NT/ LT		
	Nutrients total phosphorus		X			NT/ LT				NT/ LT				NT/ LT			LT	NT				NT/ LT		
Habitat Access	Physical barriers			X			NT/ LT				NT/ LT		LT		ST		NT/ LT						NT/ LT	
Habitat Elements	Nonnative species (in-water plants and animals)			X		NT/ LT				NT/ LT				NT/ LT						NT/ LT		NT/ LT		
	Shoreline upwelling	U	U	U				NT/ LT				NT/ LT				NT/ LT				NT/ LT				NT/ LT
	Overhanging vegetation			X		NT/ LT				NT/ LT				NT/ LT			LT	NT				NT/ LT		
	Substrate composition			X		NT/ LT				NT/ LT				NT/ LT				NT/ LT				NT/ LT		
	Large woody debris			X		NT/ LT				NT/ LT				NT/ LT			LT	NT				NT/ LT		
Shoreline Conditions	Shoreline vegetation, riparian structure, and total impervious area			X		NT/ LT				NT/ LT				NT/ LT				NT		LT		NT/ LT		
	Shoreline profile			X		NT/ LT				NT/ LT			LT	NT			LT	NT				NT/ LT		
	Shoreline ambient light		X			NT/ LT				NT/ LT				NT/ LT			LT	NT				NT/ LT		

Source: Adapted from *Lake Matrix of Pathways and Indicators for Lake Washington, Lake Sammamish, and the Ship Canal, including Lake Union* (NOAA Fisheries, March 11, 2003 draft).
Notes:
NT: Near-term conditions (5 years).
NPC: Tends toward not properly functioning condition.
X: Existing condition.
LT: Long-term conditions (50 years).
N: Neutral.
PFC: Tends toward properly functioning condition.
U: Unknown.

8.0 Environmental Conditions and Risk Analysis for Wildlife Habitat Conservation Areas

This chapter provides a discussion of the environmental conditions and an analysis of the expected environmental risk associated with the proposed Council-Modified Alternative for updating critical areas protection for wildlife habitat conservation areas in the City of Bellevue.

There are no differences in regulatory requirements between the Regulatory Alternative and the Council-Modified Alternative specific to protecting wildlife habitat; therefore, for most indicators, the near-term (5 years) and long-term (50 years) environmental effects of the Council-Modified Alternative would be the same as effects of the Regulatory Alternative.

However, because protection of wildlife habitat is largely dependent on the regulatory protections afforded streams, shorelines, wetlands, buffers, and setbacks, the differences between the Council-Modified Alternative and the Regulatory Alternative for buffer requirements and for uses allowed in setbacks reduce the efficacy of the Council-Modified Alternative. In addition, the Council-Modified Alternative would allow vegetation removal and pruning within the structure setback of a steep slope, whereas the Regulatory Alternative would restrict removal of vegetation within the 75-foot buffer required from the toe of a steep slope. The specific wildlife habitat indicators that would be less protected by the reduced buffers and less restrictive setback uses in the Council-Modified Alternative include the area of habitat, landscape connectivity, and the coverage of nonnative species.

8.1 Road Density

Council-Modified Alternative: The aspects of the Council-Modified Alternative affecting the road density indicator include increasing buffers and setting impervious surface limits. Incentives would be provided to developers to preserve habitat linkages.

The Council-Modified Alternative would maintain the *not properly functioning* status of the road density indicator in the near term, because it would not affect existing road density conditions. It would have a neutral effect in the long term, because undeveloped properties would be regulated under more protective regulations than under the No-Action Alternative. The Council-Modified Alternative would continue to degrade conditions in the near term and maintain degraded conditions in the long term.

8.2 Area of Habitat

Council-Modified Alternative: The Council-Modified Alternative affecting wildlife habitat areas would rely on regulated critical areas such as streams, shorelines, wetlands, buffers, and setbacks to support habitat functions. Both the Regulatory Alternative and the Council-Modified

Alternative would require a wildlife habitat overlay, and habitat protection measures would be implemented to protect valued and mature habitat types. Incentives aimed at preserving habitat linkages would be provided. If special status species are present, a habitat management plan must be submitted to ensure long term protection of the area.

However, in the case of shoreline and stream buffers, the Council-Modified Alternative would permit impervious surfaces such as patios, driveways, sport courts, and surface parking to be located within the structure setback, allowing development to occur up to 25 feet closer to the stream or shoreline than under the Regulatory Alternative.

On developed lots (which constitute most of the lots in the shoreline and adjacent to streams), the native vegetation protected by buffer requirements under the Council-Modified Alternative would be approximately 50 percent of the area protected under the Regulatory Alternative. In addition, there would be no requirement to mitigate these effects by enhancing buffer area. This would reduce the area of habitat compared to the area that could be obtained under the Regulatory Alternative.

The Council-Modified Alternative would maintain the *not properly functioning* status of the habitat area indicator in the near term and in the long term. The Council-Modified Alternative would maintain existing degraded conditions in the near term and in the long term.

8.3 Average Core Area

Council-Modified Alternative: The Council-Modified Alternative would rely on regulated critical areas (such as riparian corridors, shorelines, wetlands, frequently flooded areas, geologic hazards, buffers, and setbacks) to provide core habitat areas. Both the Regulatory Alternative and the Council-Modified Alternative would require a wildlife habitat overlay, and habitat protection measures would be implemented to protect valued and mature habitat types.

The Council-Modified Alternative would maintain the *not properly functioning* status of the average core area indicator in the near term because it would not affect existing land use conditions. It would have a neutral effect in the long term, because undeveloped properties would be regulated under more protective regulations than under the No-Action Alternative. The Council-Modified Alternative would continue to degrade conditions in the near term and maintain degraded conditions in the long term.

8.4 Ratio of Core Area to Core Edge Length

Council-Modified Alternative: The Council-Modified Alternative would rely on regulated critical areas to decrease the edge length of core habitat areas. As with the Regulatory Alternative, the Council-Modified Alternative would require a wildlife habitat overlay, and habitat protection measures would be implemented to protect valued and mature habitat types.

Because the Council-Modified Alternative would require narrower buffers on streams and allow for uses in setbacks that increase core edge length, it would continue to degrade the *not properly functioning* status of the ratio of core area to core length indicator in the near term and the long term. As a result, the Council-Modified Alternative would continue to degrade existing conditions in the near term and in the long term.

8.5 Landscape Connectivity

Council-Modified Alternative: The Council-Modified Alternative would require a wildlife habitat overlay, and habitat protection measures would be implemented to protect valued and mature habitat types. Incentives aimed at preserving habitat linkages would be provided. However, the Council-Modified Alternative differs from the Regulatory Alternative in that it would allow impervious surfaces such as patios, driveways, sport courts, and surface parking to be located within the structure setbacks of shorelines and streams. Therefore, breaks in landscape connectivity would be allowed up to 25 feet closer to a shoreline or stream than allowed under the Regulatory Alternative.

For example, on city shorelines, developed lots with native vegetation protected by buffer requirements under the Council-Modified Alternative would be approximately 50 percent of the area protected under the Regulatory Alternative. Similarly, on developed lots under the Council-Modified Alternative, the minimum distance between a structure and a given stream type would be less than under the Regulatory Alternative. For example, Type S streams would have a 50-foot buffer and a 50-foot structure setback under the Council-Modified Alternative, so that a new structure could be 100 feet from the stream rather than at least 120 feet as required under the Regulatory Alternative.

In addition, although the total impervious surface allowed on an individual lot would be the same under the Council-Modified Alternative as allowed under the Regulatory Alternative, impervious surfaces such as patios, driveways, sport courts, and surface parking could be located within the structure setback, and thus could be up to 50 feet closer to the stream (for Type S streams) than under the Regulatory Alternative. Finally, there would be no requirement to mitigate these effects by enhancing buffer area. This provision of the Council-Modified Alternative would reduce the connectedness of the landscape compared to the Regulatory Alternative.

The Council-Modified Alternative would maintain the *not properly functioning* status of the landscape connectivity indicator in the near term and in the long term. The Council-Modified Alternative would contribute to existing degraded conditions in the near term and maintain them in the long term.

8.6 Priority Habitat Area

Council-Modified Alternative: The Council-Modified Alternative affecting protection of priority habitats would require a wildlife habitat overlay, and habitat protection measures would

be implemented to protect valued and mature habitat types, just as under the Regulatory Alternative. If special status species are present, a habitat management plan must be submitted specifying measures for long-term protection of the habitat. Although these measures are not expected to increase the area of priority habitat within the city, they would ultimately reduce the loss of these habitats.

The Council-Modified Alternative would maintain the *not properly functioning* status of the priority habitat indicator in the near term and the long term. The Council-Modified Alternative is not expected to increase the area of priority habitat. The Council-Modified Alternative would continue to degrade areas of priority habitat in the near term and would maintain their at-risk condition in the long term.

8.7 Coverage of Nonnative Species

Council-Modified Alternative: The Council-Modified Alternative would create an allowed use for habitat enhancement projects in buffers and setbacks within critical areas. The use of supplemental planting would be revised to allow for habitat enhancement and to support critical area improvement projects, subject to performance standards. Although habitat enhancement would be allowed within setbacks and buffers, most property owners would request permission for such activities only when seeking to develop property within the buffer or setback of a wetland. Such mitigation would not be required for development within a stream or shoreline setback. No other incentives would be provided.

The Council-Modified Alternative would maintain the *not properly functioning* condition of the nonnative species indicator in the near term and the long term. The Council-Modified Alternative would not significantly reduce the expansion of nonnative species coverage and would further degrade existing conditions in both the near term and the long term.

8.8 Conclusion

Table 8-1 summarizes the results of this analysis of risk to the structure, functions, and values of wildlife habitat conservation areas.

Table 8-1. Wildlife habitat conservation areas: environmental conditions and risk analysis matrix.

Pathways and Indicators		Existing Environmental Conditions		Risk Analysis Results																			
				No-Action Alternative				Regulatory Alternative				City Programs Alternative				Best Available Science (BAS) Based Alternative				Council Modified Alternative			
Pathway	Indicator	Properly Functioning	Not Properly Functioning	PFC	NPC	N	U	PFC	NPC	N	U	PFC	NPC	N	U	PFC	NPC	N	U	PFC	NPC	N	U
Habitat Availability	Road density		X		NT/ LT				NT	LT				NT/ LT		LT		NT			NT	LT	
	Area of habitat		X			NT/ LT		LT		NT		LT		NT		LT		NT				NT/ LT	
	Average core area		X			NT/ LT		LT		NT		LT		NT		LT		NT		LT		NT	
	Ratio of core area to core edge length		X			NT/ LT		LT		NT		LT		NT		LT		NT			NT/ LT		
	Landscape connectivity		X			NT/ LT		LT		NT		LT		NT		LT		NT				NT/ LT	
	Increased acres of priority habitats		X			NT/ LT		LT		NT/ LT		LT		NT		LT		NT				NT/ LT	
	Coverage of nonnative species		X			NT/ LT				NT/ LT		LT		NT		LT		NT				NT/ LT	

PFC : Tends toward properly functioning condition.
NPC : Tends toward not properly functioning condition.
N: Neutral.
U: Unknown.
NT: Near-term conditions (5 years).
LT: Long-term conditions (50 years).

9.0 Summary and Conclusions

Tables 9-1 through 9-6 summarize the potential effects of each alternative, including the Council-Modified Alternative, on existing conditions for each critical area pathway and indicator. The tables are based on the analyses conducted within the risk analysis, including this addendum. The purpose is to determine the likely tendency of each alternative to promote protection of the properly functioning conditions of natural resources and protection of public health and safety in the near term and the long term. The tables describe the risk associated with each alternative in terms of whether it would degrade, maintain, or improve existing conditions for each indicator.

The assessment of natural resource impacts in this risk analysis derives conclusions about the effects of the alternatives relative to standards from a best available science review of literature relating to protection for and from a critical area. The results indicate the effects of implementation of each alternative on objective measures of properly functioning ecological systems.

Because Bellevue is a largely urbanized area, many ecological functions have already been impaired by development. While both the Regulatory and Council-Modified alternatives in most cases would not improve existing conditions, they would for the most part maintain existing conditions. However, for many indicators, maintaining existing conditions means maintaining conditions that are not properly functioning.

This risk analysis shows that implementation of the Council-Modified Alternative would not reverse the trend toward degradation of some critical area functions, because the alternative would generally not reverse the effects of urbanization. Many ecological functions would remain at risk or not properly functioning, even though the regulations would generally protect them from further degradation, and in some cases would improve conditions. From an environmental impact assessment standpoint, the determination that a particular ecological function would be maintained in an *at risk* or *not properly functioning* condition should not be interpreted to mean that the alternative would cause an adverse impact.

For geologically hazardous areas, critical area regulations are intended to protect human welfare, including occupied structures, utilities, and roads that people depend upon, as well as to prevent damage to natural resources. For these areas, the Council-Modified Alternative generally would provide sufficient protection to ensure that the risk of harm to essential public facilities and other development would be minimized, except for erosion hazards, which would continue to degrade. In other words, geologically hazardous areas, with the exception of erosion hazard areas, would be *properly protected*, and no adverse impacts would be expected to result from implementation of the Council-Modified Alternative.

Under existing conditions, the ecological functions of Bellevue's natural resources are *not properly functioning* or are *functioning at risk*. In comparison to the No-Action Alternative, the Council-Modified Alternative would have an overall beneficial effect on geologically hazardous

areas, streams, wetlands, shorelines, and wildlife habitat. However, the Council-Modified Alternative would not provide adequate protection to reverse the current trend toward degradation of some ecological functions.

This risk analysis indicates that, as with the Regulatory, City Programs, and BAS Based alternatives, the Council-Modified Alternative would not change the trend toward a positive or restorative direction for all of the indicators. Consequently, as with the other alternatives, in both the near term and the long term, the overall functions of the city's natural resources would continue to degrade, largely because the Council-Modified Alternative would not reverse past impacts.

The cumulative effects of implementation of the Council-Modified Alternative, together with other regulatory programs such as the storm and surface water utility code, generally would be positive. However, the Council-Modified Alternative would require additional regulations or programs to offset uses allowed in stream and shoreline setbacks in order to meet the protective standards embodied in the Regulatory Alternative for streams, shorelines, and wildlife habitat conservation areas. Nevertheless, the Council-Modified Alternative would be more protective than the No-Action Alternative.

Examples of appropriate mitigation that would improve critical area protection under the Council-Modified Alternative include the following measures:

- Require improvements to buffer vegetation where vegetation clearing or new impervious surfaces are proposed within the structure setbacks on developed lots adjacent to streams and shorelines.

- Prohibit or restrict additional impervious surfaces within structure setbacks.

- Provide a stewardship program to encourage owners of both commercial and residential properties adjacent to streams and shorelines to enhance vegetated buffers, and implement a monitoring program to measure the success of the program in improving buffers over time.

- Provide incentives such as height increases or footprint increases to property owners for incorporating critical area protection beyond regulated requirements and/or for incorporating ecological restoration of critical areas and buffers.

Table 9-1. Comparison of the trends for geologic hazard conditions by alternative.

Geologic Hazards	Near Term (5 Years)				Long Term (50 Years)			
	No-Action Alternative	Regulatory Alternative	City Programs Alternative/ Council-Modified Alternative	Best Available Science (BAS) Based Alternative	No-Action Alternative	Regulatory Alternative	City Programs Alternative/ Council-Modified Alternative	Best Available Science (BAS) Based Alternative
Ground shaking	⊖	●	⊖	⊖	⊖	●	⊖	⊖
Surface rupture	●	●	●	⊖	●	●	●	O
Liquefaction	⊖	●	⊖	⊖	⊖	●	⊖	⊖
Tsunami and seiche hazards	●	●	●	O	●	●	●	O
Erosion	●	●	O	O	●	●	O	O
Landsliding	●	●	O	O	●	●	O	O
Volcanic eruption	⊖	●	⊖	⊖	⊖	●	⊖	⊖
Coal mines	⊖	●	⊖	⊖	⊖	●	⊖	⊖

⊖ = Public health and safety would be maintained as properly protected or at risk.

O = Public health and safety would improve relative to current conditions.

● = Degraded conditions would result for public health and safety.

Table 9-2. Comparison of the trends for frequently flooded area conditions by alternative.

Frequently Flooded Areas	Near Term (5 Years)			Long Term (50 Years)		
	No-Action Alternative	Regulatory Alternative/ City Programs Alternative/ Council-Modified Alternative	Best Available Science (BAS) Based Alternative	No-Action Alternative	Regulatory Alternative/ City Programs Alternative/ Council-Modified Alternative	Best Available Science (BAS) Based Alternative
Development standards	⊖	⊖	⊖	⊖	⊖	O
Floodway conditions	⊖	⊖	⊖	⊖	O	O
Channel migration	⊖	⊖	⊖	⊖	⊖	O

⊖ = Public health and safety would be maintained as properly protected or at risk.

O = Public health and safety would improve relative to current conditions.

● = Degraded conditions would result public health and safety.

Table 9-3. Comparison of the trends for streams and riparian area conditions by alternative.

Streams and Riparian Areas		Near Term (5 Years)					Long Term (50 Years)				
		No-Action Alternative	Regulatory Alternative	City Programs Alternative	Council-Modified Alternative	Best Available Science (BAS) Based Alternative	No-Action Alternative	Regulatory Alternative	City Programs Alternative	Council-Modified Alternative	Best Available Science (BAS) Based Alternative
Water Quality	Temperature	●	●	●	●	●	●	●	○	●	○
	Sediment and turbidity	●	●	●	●	●	●	●	●	●	○
	Chemical contaminants and nutrients	●	●	●	●	●	●	●	●	●	○
Habitat Access	Physical barriers	●	⊖	●	⊖	○	●	⊖	○	⊖	○
Habitat Element	Substrate	●	●	●	●	●	●	●	●	●	●
	Large woody debris	●	●	○	●	○	●	●	○	●	○
	Pool frequency	●	●	●	●	○	●	●	●	●	○
	Pool quality	●	⊖	○	●	○	●	⊖	○	●	○
	Off-channel habitat	⊖	⊖	⊖	⊖	⊖	⊖	⊖	○	⊖	○
	Refugia	●	⊖	⊖	⊖	⊖	●	⊖	⊖	●	○
Channel Condition and Dynamics	Width/depth ratio	●	●	⊖	●	⊖	●	●	⊖	●	⊖
	Stream bank conditions	Unknown	Unknown	⊖	●	⊖	Unknown	Unknown	⊖	●	⊖
	Floodplain connectivity	●	⊖	⊖	⊖	⊖	●	⊖	○	⊖	○
Flow and Hydrology	Change in peak/base flows	●	⊖	⊖	●	⊖	●	⊖	○	●	○
	Increase in drainage network	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
	Road density & location	●	⊖	●	⊖	●	●	⊖	●	⊖	●
	Disturbance history	●	⊖	●	⊖	●	●	○	●	⊖	○
Watershed Condition	Riparian reserves	●	⊖	●	⊖	●	●	⊖	●	⊖	Unknown
	Natural disturbances	●	Unknown	Unknown	Unknown	Unknown	●	Unknown	Unknown	Unknown	Unknown
	Total impervious area	●	⊖	●	Unknown	●	●	⊖	●	Unknown	Unknown
	Riparian breaks	●	⊖	●	⊖	●	●	⊖	●	Unknown	Unknown

⊖ = Critical area would be maintained as properly functioning or at risk.

○ = Critical area functions would improve relative to current conditions.

● = Degraded conditions would result for critical area functions.

Table 9-4. Comparison of the trends for wetland conditions by alternative.

Wetlands		Near Term (5 Years)					Long Term (50 Years)				
		No-Action Alternative	Regulatory Alternative	City Programs Alternative	Council-Modified Alternative	Best Available Science (BAS) Based Alternative	No-Action Alternative	Regulatory Alternative	City Programs Alternative	Council-Modified Alternative	Best Available Science (BAS) Based Alternative
Water Regime [a]	Average water level fluctuation	●	●	●	●	●	●	○	●	○	○
	Watershed impervious area	●	●	●	●	●	●	○	●	○	○
Water Quality	Conductivity	●	●	●	●	○	●	●	●	●	○
	Total phosphorus	●	●	○	●	○	●	○	○	○	○
	Total suspended solids	●	●	○	●	○	●	○	○	○	○
	Ammonia (NH_3-N)	●	●	●	●	○	●	●	●	●	○
	Zinc	●	●	○	●	○	●	○	○	○	○
Habitat	Coverage of nonnative species	●	●	●	●	●	●	○	○	○	○
	Wetland area (acres)	●	●	●	●	●	●	●	⊖	●	○
	Area of upland habitat adjacent to a wetland	●	●	●	●	●	●	○	○	○	○
Physical Modifications	Acres of wetlands filled	●	●	●	●	○	●	●	○	●	○

[a] The city plans to revise its stormwater regulations in 2006 to provide incentives for low-impact development projects and to place additional limitations on allowed impervious area. These actions would benefit hydrologic indicators. However, they are not proposed as part of the critical areas update and are not considered here.

⊖ = Critical area functions would be maintained as properly functioning or at risk.

○ = Critical area functions would improve relative to current conditions.

● = Degraded conditions would result for critical area functions.

Table 9-5. Comparison of the trends for shoreline conditions by alternative.

Shorelines		Near Term (5 Years)					Long Term (50 Years)				
		No-Action Alternative	Regulatory Alternative	City Programs Alternative	Council-Modified Alternative	Best Available Science (BAS) Based Alternative	No-Action Alternative	Regulatory Alternative	City Programs Alternative	Council-Modified Alternative	Best Available Science (BAS) Based Alternative
Water Quality	Temperature/dissolved oxygen	●	●	●	●	●	●	Unknown	○	●	○
	pH	●	●	●	●	●	●	●	Unknown	●	Unknown
	Chemical contaminants	●	●	●	●	●	●	Unknown	●	●	○
	Nutrients/total phosphorus	●	●	●	●	●	●	●	●	●	○
Habitat Access	Physical barriers	●	⊖	○	⊖	○	●	⊖	○	⊖	○
Habitat Element	Nonnative species (in-water plants and animals)	●	●	Unknown	●	Unknown	●	●	●	●	Unknown
	Shoreline upwelling	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
	Overhanging vegetation	●	●	●	●	●	●	●	●	●	○
	Substrate composition	●	●	●	●	●	●	●	●	●	●
	Large woody debris	●	●	●	●	●	●	●	●	●	○
Shoreline Conditions	Shoreline vegetation, riparian structure, and total impervious area	●	●	●	●	●	●	●	●	●	Unknown
	Shoreline profile	●	●	●	●	●	●	●	○	●	○
	Shoreline ambient light	●	●	●	●	●	●	●	●	●	○

⊖ = Critical area functions would be maintained as properly functioning or at risk.

○ = Critical area functions would improve relative to current conditions.

● = Degraded conditions would result for critical area functions.

Table 9-6. Comparison of the trends for wildlife habitat conservation area conditions by alternative.

Wildlife Habitat Conservation Areas	Near Term (5 Years)					Long Term (50 Years)				
	No-Action Alternative	Regulatory Alternative	City Programs Alternative	Council-Modified Alternative	Best Available Science (BAS) Based Alternative	No-Action Alternative	Regulatory Alternative	City Programs Alternative	Council-Modified Alternative	Best Available Science (BAS) Based Alternative
Road density	●	●	●	●	●	●	⊖	●	⊖	○
Area of habitat	●	●	●	●	●	●	○	○	●	○
Average core area	●	●	●	●	●	●	○	○	⊖	○
Ratio of core area to core edge length	●	●	●	●	●	●	○	○	●	○
Landscape connectivity	●	●	●	●	●	●	○	○	⊖	○
Priority habitat area	●	●	●	●	●	●	●	○	⊖	○
Coverage of nonnative species	●	●	⊖	●	●	●	●	○	●	○

⊖ = Critical area functions would be maintained as properly functioning or at risk.

○ = Critical area functions would improve relative to current conditions.

● = Degraded conditions would result for critical area functions.

10.0 References

Bedwell, Heidi. 2006. Personal communication (email to José Carrasquero, Herrera Environmental Consultants, regarding geographic information system (GIS) summary of approximate percentages for locations of primary structures along the shorelines and bulkheads). Environmental planning manager, City of Bellevue. March 8, 2006.

Berens, K., M. Paine, and H. Bedwell. 2006. Personal communication (internal City of Bellevue memo providing comments on the preliminary final EIS for the City of Bellevue Critical Areas Update. City of Bellevue, Washington. April 18, 2006.

Bellevue, City of. 1999. Geographic information system (GIS) shapefiles associated with Bellevue's shorelines. Provided to Herrera Environmental Consultants in October 2004. File names: <bulk_w.shp> and <bulk_e.shp>.

Bellevue, City of. 2003. Bellevue Critical Areas Update—Best Available Science Paper: Streams. City of Bellevue, Planning and Community Development.

Bellevue, City of. 2005. Critical Areas Update: Bellevue, Washington—Draft Environmental Impact Statement. City of Bellevue, Planning and Community Development.

Bellevue, City of. 2006. Geographic information system (GIS) shapefiles associated with Bellevue's streams, parcels, and buildings. Provided to Herrera Environmental Consultants in January 2006. File names: <streams.shp>, <lisparcel.shp>, and <building.shp>.

Herrera. 2005a. City of Bellevue Critical Areas Update: 2005 Best Available Science (BAS) Review. Prepared for the City of Bellevue by Herrera Environmental Consultants, Seattle, Washington.

Herrera. 2005b. City of Bellevue's Critical Areas Update: Risk Analysis of No Action, Regulatory, City Programs, and Best Available Science Alternatives for Improving Critical Areas Protection. Prepared for the City of Bellevue by Herrera Environmental Consultants, Seattle, Washington. June 16, 2005.

NMFS. 1996. Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale. National Marine Fisheries Service, Environmental and Technical Services Division, Habitat Conservation Branch, Lacey, Washington.

NOAA Fisheries. 2003. Lake Matrix of Pathways and Indicators for Lake Washington, Lake Sammamish, and the Ship Canal, including Lake Union. March 11, 2003 draft. National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

USACE. Undated. Proposed Department of the Army Regional General Permit (RGP-3): Construction of New or Expansion of Existing Residential Overwater Structures and Drive Moorage Piling in Lake Washington, Lake Sammamish, the Sammamish River and Lake Union, Including the Lake Washington Ship Canal. Draft awaiting concurrence from U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration, National Marine Fisheries Service. U.S. Army Corps of Engineers, Seattle District.